FORM PTO-1390
(REV. 9-2001)

U.S. DEPARTMENT O

ATTORNEY'S DOCKET NUMBER
20568-69181

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (If known, see 37 CFR 1.5
Unknown 10/030377

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/US00/00032	03 January 2000	12 July 1999

TITLE OF INVENTION
EFFICIENT SUPPORT FOR VP/VC GROUPS

APPLICANT(S) FOR DO/EO/US
OREN, Yair

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.

2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.

3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.

4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).

5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
    a. ☒ is attached hereto (required only if not communicated by the International Bureau).
    b. ☐ has been communicated by the International Bureau.
    c. ☒ is not required, as the application was filed in the United States Receiving Office (RO/US).

6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
    a. ☐ is attached hereto.
    b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).

7. ☒ Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
    a. ☐ are attached hereto (required only if not communicated by the International Bureau).
    b. ☐ have been communicated by the International Bureau.
    c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
    d. ☒ have not been made and will not be made.

8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).

9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). **(2 sheets)**

10. ☐ An English lanuage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.

12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.

13. ☒ A FIRST preliminary amendment.

14. ☐ A SECOND or SUBSEQUENT preliminary amendment.

15. ☐ A substitute specification.

16. ☐ A change of power of attorney and/or address letter.

17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.

18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).

19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).

20. ☒ Other items or information:
    1. Copies of PCT International Search Report and Each Reference Cited Therein
    2. Copy of PCT International Preliminary Examination Report

U.S. APPLICATION NO. (Unknown, (37 CFR 1.5)) **10/030377** | INTERNATIONAL APPLICATION NO **PCT/US00/00032** | ATTORNEY'S DOCKET NUMBER **20568-69181**

Unknown

2 6 OCT 2001

21 ☒ The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):

Neither international preliminary examination fee (37 CFR 1.482)
nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO
and International Search Report not prepared by the EPO or JPO $1040.00

International preliminary examination fee (37 CFR 1.482) not paid to
USPTO but International Search Report prepared by the EPO or JPO $890.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO
but international search fee (37 CFR 1.445(a)(2)) paid to USPTO $740.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO
but all claims did not satisfy provisions of PCT Article 33(1)-(4) $710.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO
and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00

	CALCULATIONS PTO USE ONLY
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 100.00
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$ -0-

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	$	
Total claims	7 - 20 =	-0-	x $18.00	$ -0-	
Independent claims	1 - 3 =	-0-	x $84.00	$ -0-	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $280.00	$ -0-	
TOTAL OF ABOVE CALCULATIONS =				$ 100.00	
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2. +				$ -0-	
SUBTOTAL =				$ 100.00	
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				$ -0-	
TOTAL NATIONAL FEE =				$ 100.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property +				$ -0-	
TOTAL FEES ENCLOSED =				$ 100.00	

Amount to be refunded:	$
charged:	$

a. ☒ A check in the amount of $ 100.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees.
A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any
overpayment to Deposit Account No. 10-0435 A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card
information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR
1.137 (a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO:

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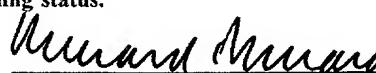
Richard Conard
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Richard D. Conard
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REGISTRATION NUMBER

RDC/mje

BARNES & THORNBURG

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group: Unknown	}
Attorney Docket: 20568-69181	}
Applicant: OREN, Yair	}
Invention: EFFICIENT SUPPORT FOR VP/VC GROUPS	}
U.S. Serial No: Unknown	}
International. Serial No: PCT/US00/00032	}
International Filing Date: 03 January 2000 (03.01.00)	}
Earliest Priority Date: 12 July 1999 (12.07.99)	}

FIRST PRELIMINARY AMENDMENT

Attention: DO/EO/US
Box PCT
Commissioner for Patents
Washington, D.C. 20231

Sir:

    Preliminary to the examination of the above-identified national patent application submitted herewith, applicant requests entry of the following amendment.

Abstract

    Please enter the Abstract of the Disclosure submitted as a separate paper herewith.

<u>In the Description</u>

After the title, please insert the following paragraph:

<u>Cross-References to Related Applications</u>

This application is a U.S. national counterpart application of international application serial No. PCT/US00/00032 filed January 3, 2000, which claims priority to U.S. provisional application serial No. 60/143,402 filed July 12, 1999.

REMARKS

This Preliminary Amendment is being submitted to indicate the relationship of the subject U.S. national application to previously filed applications as required under 37 C.F.R. 1.78.

No amendment is believed to go beyond the disclosure in the international application as originally filed.

With the entry of the foregoing amendments, the application is believed to be in condition for examination and allowance. Consideration of the claims, leading to their allowance and passage of the application to issuance, is respectfully requested.

Respectfully submitted,

[signature]

Richard D. Conard
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Abstract of the Disclosure

A method for supporting VP/VC groups in asynchronous transfer mode (ATM) switching systems that implement ATM automatic protection switching (APS). A source (SA) transmits traffic substantially continuously on two paths and a destination (SB), or sink, selects at any time one of the traffic from only one of the paths for further processing. The method includes creating a groups table having an entry for each of the two instances of every active VP/VC group's member set. Each entry indicates whether the cells for that instance of the member circuits of that VP/VC group should be forwarded or discarded. Each entry references a corresponding entry in the groups table by means of a pointer. The method includes accessing a relevant entry in the groups table when a cell for that circuit arrives, discarding the cell if the accessed value is "discard," and forwarding the cell as specified in the specific lookup table entry for that circuit if the accessed value is otherwise. Protection switching for a group requires only changing the value of the corresponding two entries in the groups table, a single operation regardless of the number of member circuits in the group.

10/030377

Rec'd PCT/PTO 26 OCT 2002

EFFICIENT SUPPORT FOR VP/VC GROUPS

Field of the Invention

This invention relates to protection of networks in the event of physical
faults in the networks, such as breaks in network connections. It is disclosed in the
context of an efficient method for supporting virtual path/virtual channel (VP/VC)
groups in asynchronous transfer mode (ATM) switching systems that implement ATM
automatic protection switching (APS). However, the invention is believed to be useful
in other applications as well.

Background of the Invention

ATM APS is described in the I.630 specification of the International
Telecommunications Union (ITU-T). ATM APS provides a mechanism for quick
recovery from physical faults, akin to APS mechanisms used in synchronous optical
networks (SONETs). The protected entity in this case is an ATM VP or VC circuit.
A description of ATM APS as specified by ITU-T specification I.630 will aid in
understanding the invention.

Referring to Fig. 1, consider an ATM network with arbitrary topology,
and an ATM circuit (either VPC or VCC) extending from a node A to a node B, where
node A is connected to a switching system S_A and node B is connected to a switching
system S_B. In the context of traffic flow from A to B, the protection domain for this
circuit extends from S_A to S_B. S_A is sometimes referred to as the source for the
protection domain of the circuit. S_B is sometimes referred to as the sink for the
protection domain of the circuit. Other nodes on the paths between source and sink
are sometimes referred to as intermediate nodes along the protected circuit.

ITU-T specification I.630 describes two different types of protection,
so-called "1+1" protection, in which the source transmits (multicasts) the traffic
constantly on both paths and the sink selects at any time one of the incoming traffic
streams and forwards it to the egress, and so-called "1:1" protection, in which the
source transmits the traffic on only one of the paths. When that path becomes
disconnected, the source switches to transmit on the alternate path. An intermediate
node that senses a problem on its associated path notifies the sink node using the AIS

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operations and maintenance (OAM) cell. The sink then effects a protection switch
(1+1 protection) or notifies the source that the source should switch to the alternate
path(1:1 protection).

5   Disclosure of the Invention

                 According to the invention, a method is provided for supporting
VP/VC groups in ATM switching systems that implement ATM APS in which traffic
flows substantially continuously from a source on two paths and a destination selects
traffic from only one of the paths at a time for further processing. The method
10   includes creating a groups table having an entry for each of the two instances of every
active VP/VC group's member set. Each entry indicates whether the cells for that
instance of the member circuits of that VP/VC group should be forwarded or
discarded. Each entry references a corresponding entry in the groups table by means
of a pointer. The method includes accessing a relevant entry in the groups table when
15   a cell for that circuit arrives, discarding the cell if the accessed value is "discard," and
forwarding the cell otherwise. Protection switching for a group thus requires only
changing the values of the corresponding two entries in the groups table, a single
operation regardless of the number of member circuits in the group.

                 Illustratively according to the invention, forwarding the cell includes
20   maintaining a lookup table containing entries for forwarding cells, and forwarding the
cell as specified in the specific lookup table entry for that circuit.

                 Further illustratively according to the invention, creating the groups
table includes implementing the groups table as part of the circuitry of the switching
system.

25   Additionally illustratively according to the invention, the method
includes determining the number of supported groups in part based upon the size of the
groups table.

                 Illustratively according to the invention, the method includes
determining the number of supported groups in part based upon the number of bits
30   allocated to the groups table pointer in the lookup table entry.

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Further illustratively according to the invention, accessing a relevant entry in the groups table when a cell for that circuit arrives includes accessing a relevant entry in the groups table when a non-zero value of the pointer field arrives.

Additionally illustratively according to the invention, accessing a relevant entry in the groups table when a cell for that circuit arrives includes determining that VC circuit's or VP circuit's forward/discard status should be determined from the lookup table entry itself when a value of zero in the pointer field arrives, indicating that the corresponding VC circuit or VP circuit is not a member of a group.

Brief Description of the Drawings

The invention may best be understood by referring to the following detailed description and accompanying drawing which illustrates the invention. The drawing is a highly diagrammatic illustration of a system incorporating the invention.

Detailed Descriptions of Illustrative Embodiments

Referring now to the drawing, in the context of 1 + 1 protection, there is a need for a mechanism by which any failure in the network 12 connecting S_A to S_B will not disrupt the traffic flow between A and B. In order to achieve that, two diverse paths, or circuits, 14, 16 in the network 12 need to be established between S_A and S_B. If one of the paths 14, 16 is disconnected, traffic can still flow through the other path. Protecting each circuit between a source and a sink individually works well when the number of circuits is relatively small. When the number of circuits is very large, for example, in the tens of thousands, monitoring each circuit for AIS notifications and protection switching consumes substantial network 12 capacity. In many networks 12, many circuits follow the same path in the network 12 from end to end, and are thus similarly affected by any network fault. For these reasons, ITU-T specification I.630 groups circuits into VP/VC groups.

A VP/VC group is a set of VP circuits (VPCs) and VC circuits (VCCs - - both VCCs and VPCs may be members of the same set) which are all associated with a specific APS VCC. The two instances of the APS VCC of the group follow the same end-to-end paths as the protected circuits (from source to sink) and in particular

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traverse the same intermediate nodes. When such an intermediate node detects a problem affecting the circuits associated with the VP/VC group, that intermediate node notifies the sink by sending an AIS OAM cell on the corresponding APS VCC. When the sink receives such a problem indication on the APS VCC of a specific

5 VP/VC group, the sink effects a protection switching for all member circuits of that VP/VC group. Therefore, the sink node only needs to monitor the APS VCCs of the different VP/VC groups for AIS indications.

ATM switching systems generally incorporate the ability to use the virtual path identifier/virtual channel identifier (VPI/VCI) value of each incoming ATM

10 cell to look up an entry in a lookup table corresponding to this VPC or VCC. There may physically be several lookup tables, for example, one per input port. However, their concatenation can logically be considered as a single lookup table. This entry in the lookup table determines, among other things, how the cell should be handled, for example, whether the cell should be forwarded or discarded, and, if the decision is that

15 the cell should be forwarded, to which output port of the switch, S_B for example, it should be forwarded.

The sink node of a 1+1 protected ATM circuit has two incoming "copies" of the protected circuit, each on a different port. Each such copy is mapped to a different entry in the lookup table, and both of those entries route the incoming

20 cells to the same outgoing circuit, for example, the circuit to node B. At any time, one of the entries for the incoming circuits will have the cells forwarded while the other entry will have them discarded. This results in having the cells from one copy of the incoming circuit forwarded to the output, and the cells from the other copy being discarded. A protection switching operation for this circuit thus changes the tagging in

25 one entry from "forward" to "discard" and changes the tagging in the other entry from "discard" to "forward."

This manipulation of the lookup table entries can be carried out by a software process in the switch processor, which also determines if a protection switching operation is required in the first place. If the event that triggered the

30 protection switching operation affects relatively few circuits, the processing time required to update the relevant lookup table entries is relatively small. However, when the event requires a protection switching operation for a large group of VCCs or

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VPCs, the required processing time may be excessive. A hardware-based mechanism can speed up the effecting of a protection switching operation for a VP/VC group.

In order to support VP/VC groups efficiently, it is desirable that whenever the forward/discard status of a group changes, that that change be reflected in a single entry and not in the entry of every member circuit. This is achieved by creating a groups table that has two entries for every active group, one for each of the two instances of that group's member set. The entry specifies whether the cells for that instance of the member circuits of that group should be forwarded or discarded. The entry in the lookup table for each individual circuit references the corresponding entry in the groups table by means of a pointer. When a cell for that circuit arrives, the relevant entry in the groups table is accessed. If the accessed value is "discard," the cell is discarded. Otherwise, the cell is forwarded as specified in the specific lookup table entry for that circuit.

Thus a protection switching operation for a group requires only changing the value of the corresponding two entries in the groups table, a single operation regardless of the number of member circuits in the group. The groups table is implemented as part of the hardware circuitry of the switching system. The number of supported groups is arbitrary, and is determined by the size of the groups table and the number of bits allocated to the groups table pointer in the lookup table entry.

This mechanism also supports VCCs or VPCs that are not members of any group. Specifically, a value of zero in the pointer field of the lookup table entry indicates that the corresponding VCC or VPC is not a member of a group, and that that VCC's or VPC's forward/discard status should be determined from the lookup table entry itself. Any other value of the pointer field constitutes a valid index into the group table.

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CLAIMS:

1.   A method for supporting virtual path/virtual channel (VP/VC) groups in asynchronous transfer mode (ATM) switching systems that implement ATM automatic protection switching (APS) in which traffic flows substantially continuously from a source on two paths and a destination selects traffic from only one of the paths at a time for further processing, the method including creating a groups table, the groups table having an entry for each of the two instances of every active VP/VC group's member set, each said entry indicating whether the cells for that instance of the member circuits of that VP/VC group should be forwarded or discarded, each said entry referencing a corresponding entry in the groups table by means of a pointer, the method including accessing a relevant entry in the groups table when a cell for that circuit arrives, discarding the cell if the accessed value is "discard," and forwarding the cell otherwise.

2.   The method of claim 1 wherein forwarding the cell includes maintaining a lookup table containing entries for forwarding cells, and forwarding the cell as specified in the specific lookup table entry for that circuit.

3.   The method of claim 1 wherein the groups table is implemented as part of the circuitry of the switching system.

4.   The method of claim 1 wherein the number of supported groups is determined in part by the size of the groups table.

5.   The method of claim 2 wherein the number of supported groups is determined in part by the number of bits allocated to the groups table pointer in the lookup table entry.

6.   The method of claim 1 wherein any value of the pointer field other than zero constitutes a valid index into the group table.

7.   The method of claim 6 wherein a value of zero in the pointer field of the lookup table entry indicates that the corresponding VC circuit or VP circuit is not a member of a group, and that that VC circuit's or VP circuit's forward/discard status should be determined from the lookup table entry itself.
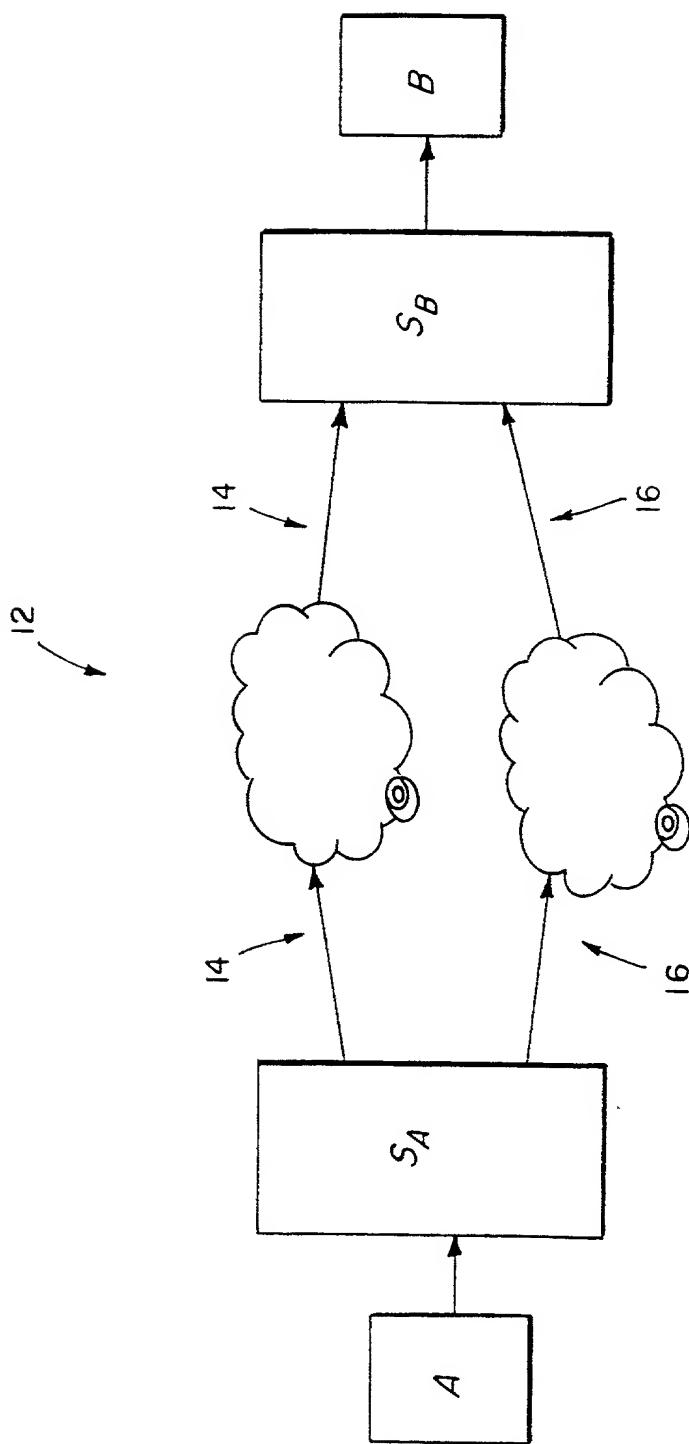
DECLARATION AND POWER OF ATTORNEY -- PATENT APPLICATION

As a below named inventor, I hereby declare that I believe I am the original, first and sole inventor (*if only one name is listed below*) or an original, first and joint inventor (*if plural names are listed below*) of the subject matter which is claimed and for which a patent is sought in the application entitled:

EFFICIENT SUPPORT FOR VP/VC GROUPS _____ -,the

specification of which

(*check one*)

      _____ is attached hereto

      XX ___ was filed on   **03 January 2000 (03.01.00)** _____ as

United States Application Serial No. _____ or

PCT International Application No.   **PCT/US00/** _____

and was amended on _____

                  (if applicable)

I hereby declare that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to herein.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) of any foreign application(s) for patent or inventor's certificate on which priority is claimed (as listed below) and I have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)   Priority Claimed

(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No

I hereby claim benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below.

60/143,402 _____   **12 July 1999 (12.07.99)** _____

Application Number   Filing Date

_____   _____

Application Number   Filing Date

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(b) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

Application Serial No.	Filing Date	Status-patented, pending, abandoned
Application Serial No.	Filing Date	Status-patented, pending, abandoned

I hereby appoint William R. Coffey, Reg. No. 24023; Richard D. Conard, Reg. No. 27321; Steven R. Lammert, Reg. No. 27653; Richard A. Rezek, Reg. No. 30796; Timothy E. Niednagel, Reg. No. 33266; Nancy J. Harrison, Reg. No. 27083; R. Trevor Carter, Reg. No. 40549; Dilip A. Kulkarni, Reg. No. 27510; David B. Quick, Reg. No. 31993; Jill T. Powlick, Reg. No. 42088; Norman J. Hedges, Reg. No. 44151; Arland T. Stein, Reg. No. 28062; William B. Richards, Reg. No. 44301; Kenneth J. Waite, Reg. No. 45189; Thomas S. Reynolds II, Reg. No. 45262; Perry Palan, Reg. No. 26213; Mark M. Newman, Reg. No. 31472; Bobby B. Gillenwater, Reg. No. 31105; Paul B. Hunt, Reg. No. 37154; Michael S. Gzybowski, Reg. No. 32816; Gerard T. Gallagher,

Reg. No. 39679; Robert D. Null, Reg. No. 40746; Alice O. Martin, Reg. No. 35601; and Gregory S. Cooper, Reg. No. 40965, as attorneys of record with full power of substitution and revocation, to prosecute this application, and to transact all business in the Patent and Trademark Office connected therewith, and I specify that communications regarding the application be directed to:

BARNES & THORNBURG
11 South Meridian Street
Indianapolis, Indiana 46204
Telephone (317) 236-1313

      I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Yair OREN	Israel (IL) ILX
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Additional inventors to be similarly identified on attached sheet.

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11/99